Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Standard level
Paper 2

Thursday 14 May 2015 (afternoon)

Candidate session number

1 hour

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[40 marks]**.

2215 – 6205

20 pages

Section A

Answer **all** questions. Write your answers in the boxes provided.

1. **Figure 1** shows a view of Windsor Castle (UK) in which 500 people work and it is also a residence for the Royal Family. In 2013 a hydroelectric scheme was installed in the River Thames, 500 metres from the castle in order to halve the carbon emissions. The scheme is based on a 2000-year old design of Greek mathematician and engineer, Archimedes, who used giant screws in Ancient Greece to pump low-lying water to irrigate higher areas. The Windsor Castle scheme uses two screws turned by the force of river water rushing over a two-metre-high weir (man-made waterfall). Each screw is connected to a gearbox and a generator which produces electricity. **Figure 2** shows a view of Romney Lock on the River Thames where the hydroelectric scheme is located and **Figure 3** shows a closer view of the screw mechanism. **Table 1** shows data relating to the hydroelectric scheme.

Figure 1: Windsor Castle

[Source: http://en.wikipedia.org/wiki/Windsor_Castle#/media/File:Windsor_Castle_from_the_Air_wideangle.jpg]

Figure 2: Romney Lock

[Source: © RWE npower]

Figure 3: Screw mechanism

Removed for copyright reasons
Please go to this link: http://www.bbc.co.uk/news/uk-england-berkshire-16276225

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(Question 1 continued)

Table 1: Data for Romney Lock hydroelectric scheme

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(a) (i) State the annual amount of carbon emissions produced by Windsor Castle prior to the installation of the hydroelectric scheme. [1]

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(ii) State **one** reason why fish may be injured by the scheme even though a fish run is installed. [1]

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(iii) List **two** reasons why the hydroelectric scheme is unlikely to maintain maximum output throughout the year. [2]

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(Question 1 continued)

(b) (i) Outline **one** reason why the spin rate data for the screws may vary. [2]

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(ii) Outline **one** reason why the data relating to 95 % of the power needs of Windsor Castle may reduce even if the hydroelectric scheme maintains maximum output. [2]

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(c) (i) State the ideas generating technique which stimulated the idea for this type of hydroelectric scheme. [1]

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(Question 1 continued)

(ii) Suggest why the data relating to 400 homes may not be accurate. [3]

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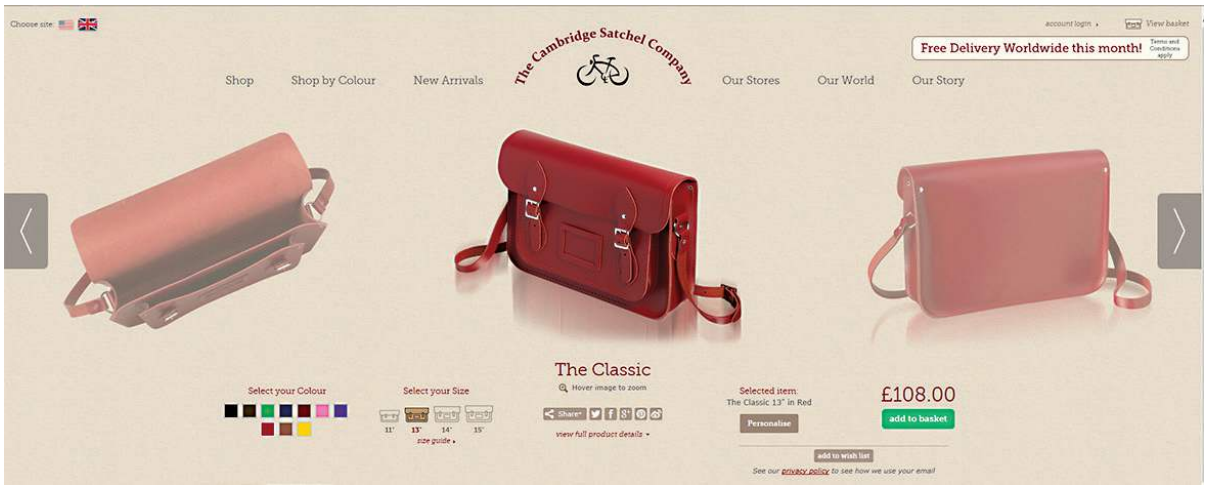
2. **Figure 4** shows leather satchels produced by the Cambridge Satchel Company (UK) available in a range of 10 bright colours and four sizes. **Figure 5** shows a detail of how the strap is joined to the bag. Natural brown leather satchels were popular with school children in the 1950s and 1960s until they became replaced by sports bags and rucksacks (backpacks). The target market for the Cambridge satchel is mainly adults.

Figure 4: Leather satchels



[Source: www.cambridgesatchelcompany.co.uk]

Figure 5: Detail showing the strap joined to the bag

[Source: www.cambridgesatchelcompany.co.uk]

(This question continues on the following page)

(Question 2 continued)

(a) State the manufacturing technique used to secure the strap to the satchel bag. [1]

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(b) Explain the influence of fashion and planned obsolescence on the design of the satchel in **Figure 4**. [3]

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3. (a) State the percentile which would be used to decide an appropriate height for the tallest shelf in a supermarket. [1]

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(b) Explain why there is no specific anthropometric data available for the “average” person. [3]

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will not be marked.

Section B

Answer **one** question. Write your answers in the boxes provided.

4. **Figure 6** shows the Biolite camp stove, an award-winning camping stove which also provides electricity to charge small devices, such as mobile (cell) phones or LED lights. The stove uses biomass fuel such as twigs or pine cones with 46 g of wood required to boil 1 litre of water which takes 4.5 minutes to boil. The stove can also be used with recycled wood pellets. The stove provides 3.4 kW at low power up to 5.5 kW at high power with 20 minutes of charging sufficient for 60 minutes of talk time on a phone. It weighs 935 g (33 oz) and the packed size is 21 cm × 12.7 cm.

Figure 6: Biolite stove

[Source: http://www.biolitestove.com/. Used with permission]

(a) (i) State why the manufacturer emphasizes the packed size of the Biolite stove. [1]

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(Question 4 continued)

(ii) Outline **one** limitation of the Biolite stove for users who undertake expeditions to locations all over the world. [2]

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(iii) Outline **one** reason why users may decide to carry wood pellets for the stove even though they will be camping in wooded areas. [2]

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(b) (i) State **one** disadvantage of the Biolite stove in relation to green design. [1]

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(ii) Evaluate the Biolite stove in relation to ease of maintenance. [3]

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(Question 4 continued)

(c) (i) Outline **one** potential safety issue when using the Biolite stove for cooking and charging an electronic device at the same time. [2]

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(ii) Discuss how the strategies of user trial, performance test and field trial could have contributed to the development of the Biolite stove. [9]

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5. **Figure 7** shows the Bagalight paper and cardboard table lamp in two designs. It costs approximately £35 and operates with a 15 W compact fluorescent lamp (CFL) type of light bulb which is secured to the cardboard base of the bag and which does not generate enough heat to damage the paper bag.

Figure 7: Bagalight table lamp

[Source: Image courtesy of Liqui Design.]

(a) (i) State the most likely manufacturing technique used to assemble the bag for the Bagalight. [1]

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(ii) Outline why the Bagalight is only produced in one colour. [2]

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(Question 5 continued)

(iii) Outline how the designer will have considered stability in the design of the Bagalight. [2]

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(b) (i) State **one** limitation of the Bagalight in relation to ease of maintenance. [1]

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(ii) Suggest **one** reason for using the shape of a traditional lamp as a surface pattern for the Bagalight. [3]

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(c) (i) Outline **one** limitation of using the Bagalight as a main source of light. [2]

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(Question 5 continued)

(ii) Suggest **three** ways in which the Bagalight may be viewed as a robust design. [9]

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6. **Figure 8** shows the Water Craft life-saving aid designed by Ross Kemp as his final year project for his design degree. As a student, Ross undertook a lifeguard training course and realized that it was difficult to move a body through water single-handedly. Existing aids were either a paddle board or jet skis but these need two people to launch them. He based his new design on the jet ski but with a sloping back to make it easier to pull someone on it. After graduation, Ross decided to try and create a marketable version of his idea so he produced a number of prototypes to test. The initial testing with the Royal National Lifeboat Institution (UK) was not a great success so further prototypes were done to get to the pre-production stage. Funding for more testing at Bondi beach in Australia was gained after the Water Craft won first prize of £10 000 in the Lloyds TSB Enterprise competition and sponsorship was raised from the media attention. **Figure 9** shows a scale model of the Water Craft.

Figure 8: Water Craft prototype

Figure 9: Ross Kemp and scale model

[Source: Image courtesy of Asap water crafts]

(a) (i) State the type of evaluation test performed at Bondi beach in Australia. [1]

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(ii) Outline **one** physiological ergonomic consideration which contributed to the idea for the Water Craft. [2]

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(Question 6 continued)

(iii) Describe the structure and bonding of a thermoplastic. [2]

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(b) (i) Outline the ideas generation technique which was the impetus for the design of the Water Craft. [1]

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(ii) Explain the reason for using scale models as part of the design development process for the Water Craft. [3]

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(Question 6 continued)

(c) (i) Outline why the Water Craft is primarily an example of market development. [2]

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(ii) Discuss Ross Kemp as an inventor, innovator and entrepreneur. [9]

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